

Meta-data description for Temperature and humidity measurements for Greater Paramaribo

As shared via <https://www.groenparamaribo.org/en/maps/>

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Authors and citation

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Sensors

Temperature and humidity are measured with wireless sensors (Kestrel D2 <https://kestrelinstruments.com/kestrel-drop-d2-humidity-logger>). These sensors have an accuracy of +/- 0.5° C for temperature and +/- 2% for humidity.

Radiation shield

Sensors are placed within a radiation shield following the guidelines in Hubbart (2011). The advantage of using such a radiation shield is mostly to avoid excessive temperature peaks due to direct sunlight heating up the logger itself, and thus is recommended in the guidelines issued by the World Meteorological Organization (WMO, 2010). The radiation shields are built using a plastic funnel and plastic cone, tube, heat shrink tube and modelling clay (Figure 1).



Figure 1: A temperature and humidity sensor within its radiation shield.

Placement of sensors

For setting up meteorological stations in non-urban areas, WMO (2010) recommends placing loggers for air temperature and humidity at a height of 1.25m to 2m above ground, and definitely no less than 1.25m. For urban areas, this means loggers could be in easy reach and potentially even in the way of vehicles. Thus, WMO suggests that for urban areas, heights of 3 to 5m are also acceptable, since this will not distort temperature readings too much. In any case, sensors should be placed far away from ventilation shafts and other sources of heat or cold. Since batteries will need to be exchanged once in a while, the sensors need to remain accessible in principle.

The sensors were placed following these recommendations, and all locations are documented with GPS coordinates, a description of the surroundings and photos.

Data format and time intervals

Temperature and humidity were recorded in metric units every hour. Data for individual sensors might have missing data if the sensor was only placed after a certain time, the battery was out at that time or the sensor was stolen and replaced only later.

Data cleaning

After retrieving the data from the sensors, the following steps to clean the data are conducted:

- Removing additional measurements not taken at the full hour, but at the time of connecting the sensor via Bluetooth to a mobile or tablet.
- Eliminating duplicate measurements for the same time.
- Manually removing data points out of plausible range
 - Temperature: 15 to 50 C
 - Humidity: 0 to 100
 - Heat stress: 15 to 50
 - Dew point: 0 to 50
- Manually removing data points if loggers wrongly logged the time of measurements briefly before a battery ran out (i.e., temperature peaks 6 or 12 hours off)

Literature

Hubbart, J.A. (2011). An Inexpensive Alternative Solar Radiation Shield for Ambient Air Temperature Micro-Sensors. *J. Nat. Environ. Sci.* 2, 9–14.

WMO (World Meteorological Organization) (2010): Guide to Meteorological Instruments and Methods of Observation. WMO report No. 8. ISBN 978-92-63-10008-5. Updated 2010.